WE CLAIM:

1. A plate for holding a plurality of samples, comprising:

a frame;

a plurality of sample wells disposed in the frame for holding a corresponding plurality of samples; and

a thermal isolation structure associated with the frame and disposed between the sample wells to reduce thermal transfer between adjacent sample wells.

2. The plate of claim 1, the frame being substantially rectangular, where the length of the frame ranges between about 125 mm and about 130 mm, and where the width of the frame ranges between about 80 mm and about 90 mm.

3. The plate of claim 1, where the number of sample wells in the plate is selected from the group consisting of 96, 384, 768, 1536, 3456, and 9600.

4. The plate of claim 1, where the density of sample wells in the plate is at least about 1 well per 81 mm^2.

5. The plate of claim 1, where the volume of each sample well in the plate is less than about 500 microliters.

6. The plate of claim 1, where the sample wells and the thermal isolation structure are composed at least in part of different materials.

7. The plate of claim 1, the sample wells having a central axis, where the thermal isolation structure substantially surrounds the central axis of each sample well without obstructing transmission of thermal infrared radiation along the central axis.

8. The plate of claim 1, where the thermal isolation structure comprises a thermal buffer disposed between the sample wells to reduce thermal transfer between adjacent sample wells, the thermal buffer having a higher thermal mass than the sample wells and corresponding samples.

9. The plate of claim 8, where at least a portion of the thermal buffer is a metal.

10. The plate of claim 9, where the metal is aluminum.

11. The plate of claim 8, where at least a portion of the thermal buffer is a high-thermal-capacitance plastic.

12. The plate of claim 8, where the thermal isolation structure further comprises a thermal barrier disposed between adjacent sample wells to reduce thermal transfer between the adjacent sample wells, the thermal barrier including an infrared-reflective material that reflects at least about half of the thermal infrared radiation incident on the barrier.

13. The plate of claim 12, where the thermal isolation structure further comprises a plurality of isolation wells disposed in the frame, where each of the sample wells is positioned in a corresponding isolation well, and where none of the isolation wells and sample wells is in fluid contact with another of the isolation wells and sample wells.

14. The plate of claim 8, where the thermal isolation structure further comprises a plurality of isolation wells disposed in the frame, where each of the sample wells is positioned in a corresponding isolation well, and where none of the isolation wells and sample wells is in fluid contact with another of the isolation wells and sample wells.

15. The plate of claim 1, where the thermal isolation structure comprises a thermal barrier disposed between adjacent sample wells to reduce thermal transfer between the adjacent sample wells, the thermal barrier including an infrared-reflective material that reflects at least about half of the thermal infrared radiation incident on the barrier.

16. The plate of claim 15, where the reflectivity of the infrared-reflective material is at least about 0.8.

17. The plate of claim 15, where the emissivity of the infrared-reflective material is at most about 0.2.

18. The plate of claim 15, where the infrared-reflective material is selected from the group consisting of AlSiO and gold.

19. The plate of claim 15, the sample wells having a top and bottom, where the tops of the sample wells define a plane, and where each straight line below the plane connecting a portion of one sample well to a portion of an adjacent sample well intersects the thermal barrier.

20. The plate of claim 15, where the thermal isolation structure further comprises a second thermal barrier disposed between adjacent sample wells to reduce thermal transfer between the adjacent sample wells, the second thermal barrier also including an infrared-reflective material that reflects at least about half of the thermal infrared radiation incident on the barrier.

21. The plate of claim 15, where a portion of the frame is disposed between the two thermal barriers.

22. The plate of claim 1, where the thermal isolation structure further comprises a plurality of isolation wells disposed in the frame, where each of the sample wells is positioned in a corresponding isolation well, and where none of the isolation wells and sample wells is in fluid contact with another of the isolation wells and sample wells.

23. The plate of claim 1, where the thermal isolation structure comprises a plurality of isolation wells disposed in the frame, where each of the sample wells is positioned in a corresponding isolation well, and where none of the isolation wells and sample wells is in fluid contact with another of the isolation wells and sample wells.

24. The plate of claim 1, further comprising a plurality of trapped volumes corresponding to each sample well, where the trapped volumes are formed between an outer surface of the sample wells and an inner surface of the corresponding isolation wells, the trapped volumes further reducing thermal transfer to and from samples in the sample wells.

25. The plate of claim 24, where the trapped volume includes air.

26. The plate of claim 24, where the trapped volume is at least partially evacuated relative to standard atmospheric pressure.

27. The plate of claim 24, where at least a portion of the trapped volume is lined by an infrared-reflective material.

28. The plate of claim 1, further comprising a cover configured to cover the sample wells, reducing evaporative heat loss from samples contained within the sample wells.

29. The plate of claim 1, further comprising a thermal reference region disposed about the sample wells in the frame, where thermal infrared radiation detected from a sample positioned in at least one of the sample wells may be calibrated using thermal infrared radiation detected from an adjacent thermal reference region.

30. The plate of claim 29, the sample wells having a central axis, where the thermal reference region includes an annular emissive reference surface positioned about the central axis of each sample well.

31. A plate device for holding a plurality of samples, comprising:

an insert member defining an array of sample wells, each sample well having a central axis; and

a support member having a thermal isolation framework in a configuration corresponding to the array of sample wells, so that when the insert member engages the support member each sample well is thermally isolated from adjacent sample wells without obstructing the transmission of thermal infrared radiation along the central axis of the sample well.

32. The plate of claim 31, where the thermal isolation framework comprises a thermal buffer disposed between the sample wells to reduce thermal transfer between adjacent sample wells, the thermal buffer having a higher thermal mass than the sample wells and corresponding samples.

33. The plate of claim 31, where the thermal isolation framework comprises a thermal barrier disposed between adjacent sample wells to reduce thermal transfer between the adjacent sample wells, the thermal barrier including an infrared-reflective material that reflects at least about half of the thermal infrared radiation incident on the barrier.

34. The plate of claim 31, where the thermal isolation framework comprises a plurality of isolation wells disposed in the frame, where each of the sample wells is positioned in a corresponding isolation well, and where none of the isolation wells and sample wells is in fluid contact with another of the isolation wells and sample wells.

35. The plate of claim 31, further comprising a cover configured to cover the sample wells, reducing evaporative heat loss from samples contained within the sample wells.

36. A plate for holding a plurality of samples, comprising:

a frame;

a plurality of isolation wells disposed in the frame; and

a corresponding sample well for holding a corresponding sample disposed in each of the isolation wells;

where none of the isolation wells and sample wells is in fluid contact with another of the isolation wells and sample wells.

37. The plate of claim 36, further comprising a plurality of trapped volumes corresponding to each sample well, where the trapped volumes are formed between an outer surface of the sample wells and an inner surface of the corresponding isolation wells, the trapped volumes further reducing thermal transfer to and from samples in the sample wells.

38. The plate of claim 37, where the trapped volume includes air.

39. The plate of claim 37, where the trapped volume is at least partially evacuated relative to standard atmospheric pressure.

40. The plate of claim 37, where at least a portion of the trapped volume is lined by an infrared-reflective material.

41. A method of detecting thermal infrared radiation, comprising:

providing a sample plate having a plurality of sample wells containing a corresponding plurality of samples, the sample plate including a thermal isolation structure disposed between the sample wells to reduce thermal transfer between adjacent sample wells;

providing an optical device configured preferentially to detect thermal infrared radiation; and

detecting thermal infrared radiation transmitted from a sample in at least one of the sample wells in the sample plate using the optical device.

42. The method of claim 41, further comprising correlating the detected radiation with the progress of a chemical or physiological reaction occurring within the sample.

43. The method of claim 41, the frame being substantially rectangular, where the length of the frame ranges between about 125 mm and about 130 mm, and where the width of the frame ranges between about 80 mm and about 90 mm.

44. The method of claim 41, where the number of sample wells in the plate is selected from the group consisting of 96, 384, 768, 1536, 3456, and 9600.

45. The method of claim 41, where the density of sample wells in the plate is at least about 1 well per 81 mm^2.

46. The method of claim 41, where the volume of each sample well in the plate is less than about 500 microliters.

47. The method of claim 41, where the sample wells and the thermal isolation structure are composed at least in part of different materials.

48. The method of claim 41, the sample wells having a central axis, where the thermal isolation structure substantially surrounds the central axis of each sample well without obstructing transmission of thermal infrared radiation along the central axis.

49. The method of claim 41, where the thermal isolation framework comprises a thermal buffer disposed between the sample wells to reduce thermal transfer between adjacent sample wells, the thermal buffer having a higher thermal mass than the sample wells and corresponding samples.

50. The method of claim 41, where the thermal isolation framework comprises a thermal barrier disposed between adjacent sample wells to reduce thermal transfer between the adjacent sample wells, the thermal barrier including an infrared-reflective material that reflects at least about half of the thermal infrared radiation incident on the barrier.

51. The method of claim 41, where the thermal isolation framework comprises a plurality of isolation wells disposed in the frame, where each of the sample wells is positioned in a corresponding isolation well, and where none of the isolation wells and sample wells is in fluid contact with another of the isolation wells and sample wells.

52. The method of claim 41, the sample plate comprising an insert portion containing the sample wells and a frame portion containing the thermal reference regions, further comprising forming the sample plate by mating the insert portion with the frame portion.

53. The method of claim 41, where the optical device comprises:

an examination site; and

a detector configured to receive and preferentially to detect thermal infrared radiation transmitted from a sample positioned within a sample well at the examination site.

54. The method of claim 41, the sample wells having a central axis, the optical device having an optical axis, further comprising aligning the central axis and the optical axis prior to the steps of detecting thermal infrared radiation.

55. The method of claim 41, further comprising shielding the sample from incident radiation to reduce the proportion of the sample signal arising from transmission, reflection, and/or photoluminescence from the sample.

56. The method of claim 41, further comprising filtering the radiation transmitted from the sample to extract thermal infrared radiation prior to the step of detecting thermal infrared radiation.

57. The method of claim 41, where at least about half of the thermal infrared radiation detected by the optical device has a wavelength between about 3 micrometers and about 5 micrometers.

58. The method of claim 41, where at least about half of the thermal infrared radiation detected by the optical device has a wavelength between about 7 micrometers and about 14 micrometers.

59. The method of claim 41, further comprising:

detecting thermal infrared radiation transmitted from a reference region adjacent the sample; and

constructing a sample signal characteristic of the thermal infrared radiation detected from the sample based on the thermal infrared radiation detected from the sample and the adjacent reference region.

60. The method of claim 59, the sample wells having a central axis, where the thermal reference region includes an annular emissive reference surface positioned about the central axis of a each sample well.

61. The method of claim 41, further comprising detecting thermal infrared radiation transmitted from a plurality of samples contained in a corresponding plurality of sample wells in the sample plate using the optical device.

62. The method of claim 61, where the thermal infrared radiation is detected simultaneously from the plurality of samples.

63. The method of claim 61, where the thermal infrared radiation is detected sequentially from the plurality of samples.

64. The method of claim 41, further comprising computing a quantity related to a characteristic of the thermal infrared radiation transmitted from the sample.

65. The method of claim 64, where the quantity is representative of the temperature of the sample.

66. The method of claim 64, further comprising:

computing the quantity for a plurality of samples; and

displaying the quantities graphically in a manner representative of the arrangement of the corresponding sample wells in the sample plate.

67. The method of claim 41, further comprising covering the sample wells to reduce evaporative heat loss from the samples.

68. The method of claim 41, further comprising:

converting the detected thermal infrared radiation to a signal; and

processing the signal to reduce the proportion of the signal that is attributable to noise.

69. The method of claim 68, where the step of processing the signal includes the step of computing a quantity based on distinguishable components of the signal representing thermal infrared radiation detected from the same sample at different times.

70. The method of claim 68, where the step of processing the signal includes the step of computing a quantity based on distinguishable components of the signal representing thermal infrared radiation detected from different portions of the same sample.

71. The method of claim 41, further comprising:

detecting thermal infrared radiation transmitted from a plurality of samples contained in the sample wells using the optical device;

converting the thermal infrared radiation detected from each sample to a corresponding signal; and

adjusting the signals so that each has the same preselected value at the same preselected time.

72. The method of claim 71, where the preselected value is zero.

73. The method of claim 71, where the preselected time is zero.

74. A method of detecting thermal infrared radiation, comprising:

providing a sample holder having a plurality of wells, each well having a central axis generally perpendicular to the sample holder; and

substantially surrounding the central axis of each well with a thermally controlled barrier structure without obstructing transmission of thermal infrared radiation along the central axis.